Commercial Fisheries Abstracts

a monthly summary of important developments for the fishery industries

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Commercial Fisheries Abstracts

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Following is a brief outline of this filing system. The numbers apply to the first digit appearing on each card. For the meaning of subsequent digits, please see the above described leaflet.

0 General and theoretical	3 Preserved fish	7 Analytical Methods
1 Fish by species	4 Oils	8 Composition
2 Fresh fish	5 Vitamins	9 Miscellaneous
	6 Fishery byproducts	

Use of funds for printing this publication has been approved by the Director of the Bureau of the Budget November 23, 1956.

1.0113 **ABUNDANCE, DISTRIBUTION AND COMMERCIAL EXPLOITATION OF THE FISHERIES RESOURCES OF CANADA'S WEST COAST**

Shepard, M. P. and Stevenson, J. C. (Fisheries Research Board of Canada, Biological Station, Nanaimo, British Columbia)
9th B. C. Natural Resources Conference Transactions, February 1956
Studies 1956, from the Fisheries Research Board of Canada, FRB No. 453, 60 pp.

The following table includes estimates of the sizes of the basic stocks exploited by British Columbia's fisheries and of the average catches provided by those stocks.

	Millions of pounds			
	Present stock	Canada	Utilization others	Total
Salmon	411.6	180.2	..	..
Sockeye salmon	83.6	41.2	16.0	57.2
Pink salmon	116.0	45.0	13.0	58.0
Chum salmon	150.0	58.0	23.0	81.0
Coho salmon	40.0	23.0	..	..
Spring salmon	22.0	13.0	..	..
Steelhead	5.0	0.6[1]/	..	..
Herring	790.0	380.0	0.0	380.0
Pacific Halibut	445.0	28.0	43.0	71.0
Groundfish	1,012.0	28.3	30.1	58.4
Lemon sole	15.0	2.8	1.3	4.1
Brill	15.0	1.5	3.5	5.0
Rock sole	40.0	3.2	0.5	3.7

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Reprinted in part

2.01 **RUSTY HERRING**

Harrison, F. C. (MacDonald College, Province of Quebec, Canada)
Contributions to Canadian Biology 1, No. 10 to 18, 279-284 (1923)

Samples of rusty herring were obtained from a number of packers in the Maritime Provinces, and cultures were made of the rusty material from various parts of the fish. These cultures were formed on 16 percent salt-codfish agar and other fish media with varying, but large, amounts of salt. The incubation was carried out at blood heat and also at room temperature.

Three weeks later nearly all the cultures showed a red growth around the red material with which they had been inoculated. Pure cultures were obtained of these growths, and the organism was found to be Pseudomonas salinaria, described in the author's paper on "The Red Discoloration of Codfish."

To prove that rusty herring could be produced by the red organisms, the author placed several lots of herring in large glass dishes, formed a brine, and then smeared several of the herring with a pure culture of the red organism. The inoculated fish were kept at room temperature, and in two weeks, the characteristic red rust appeared and then increased progressively with age. Transfers were made to various salt media. The red growth subsequently appearing was found to be Pseudomonas salinaria.

In other work, the author salted fresh herring with a tropical salt known to contain the red organism. Again rustiness developed, and again the red organism was isolated. A different sample of fresh herring that had been salted with Liverpool Salt remained fresh and bright.

Why does Pseudomonas salinaria produce a red color on cod and a rusty color on herring?

(over)

 ABSTRACTER: F. Bruce Sanford

2.00 **EFFECT OF DELAYED HANDLING UPON SHRIMP QUALITY DURING SUBSEQUENT REFRIGERATED STORAGE**

Fieger, E. A.; Bailey, M. E.; and Novak, A. F. (Louisiana State University, Baton Rouge)
Food Technology 12, 297-300 (June 1958)

Purpose. -- This study was made to evaluate the effect of delayed handling on shrimp quality.

Study number one. --Shrimp used in these studies were caught in Barataria Bay, Louisiana, with a 35-foot trawl net, emptied on deck, and delivered immediately to the laboratory where the shrimp were separated from the trash fish. The shrimp obtained in this drag were divided equally into lots numbered 1, 2, and 3. Shrimp in lot 1 (control) were headed, washed with water from Barataria Bay, sampled for a bacterial count, put into aluminum pans and covered, and packed in ice within a period of 20 minutes from the time that the net was emptied on board the trawler. Shrimp in lot 2 were held in the laboratory at 79° to 84° F. for 2 hours after which they were handled in the same manner as those in lot 1. Shrimp in lot 3 were held in the laboratory for 6 hours at 79° to 84° F. after which they were handled in the same manner as those in lot 1. Samples of shrimp were removed from lots 1, 2, and 3 after 6 and 11 days of storage in ice.

Study number two. --This study was carried out in much the same manner as study number one except that the shrimp were divided equally into lots numbered 4, 5, 6, and 7. Lots 4 and 5 were headed immediately. Lots 6 and 7 were held in the laboratory for 2 hours at 79° to 84° F. and then headed. Shrimp in lots 4 and 6 (controls) were held for 5 minutes in water from Barataria Bay, drained for 2 minutes, put into aluminum pans and covered, and packed in ice. Shrimp in lots 5 and 7 were handled in the same manner as those in lots 4 and 6 except that they were held for 5 minutes in water from Barataria Bay to which had been added 20 p. p. m. chlortetracycline (CTC), a bacteriostat, and 5,000 p. p. m. isoascorbic acid, an antioxidant. Samples of shrimp were removed from

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 ABSTRACTER: Martin Heerdt

2.3 **5,250 SHRIMP AN HOUR**

Fornea, Wayne and Ziemba, John V. (DeJean Packing Co., Biloxi, Mississippi)
Food Engineering 30, 80 (July 1958)

Introduction. -- A mechanized processing line at a Biloxi, Mississippi, plant now maintains a constant hourly flow of 5,250 pounds of shrimp through peelers, cleaners, separators, deveiners, blancher, grader, and canning machinery.

Mechanized peeling. -- As the shrimp enter the automatic peeler, they pass through a combination of 2½- and 3-inch-diameter rubber rollers and 9/16-inch-diameter metal rollers arranged on an incline. The shrimp then proceed to a second section of the peeler that is composed of 3-inch-diameter rollers arranged on a incline for the removal of the head and shell. Both the first and the second sections of the peeler have 9 rows of 36 scalloped spring-operated pressure fingers and 6 overhead water sprays that deliver about 70 gallons of water per minute. These fingers are driven by rack and rocker-arm with an up-and-down motion above the shrimp as they travel along the rollers. Heads and shells are loosened and removed as the shrimp roll downward in a zigzag direction between the moving fingers, the oscillating rubber rollers, and the metal rollers.

Cleaning and separating. -- The peeled shrimp are transported by flume from the cleaner to the separator where gristle, feet, and other waste appendages are detached and removed. This unit has 42 spring-loaded rollers graduated from 2 to 6 inches in diameter. These rollers are actuated by a ¾-horsepower, motor-driven central shaft. The rollers create a reciprocating motion that detaches the waste appendages without damaging the edible shrimp meat. The next step in the operation is the separation of the loose waste material from the shrimp. This is accomplished in two 4-foot automatic shrimp waste separators each of which is equipped with 10 pairs of 1½-inch-diameter

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 ABSTRACTER: Martin Heerdt

COMMERCIAL RESOURCES OF BRITISH COLUMBIA

RUSTY HERRING

DELAY AFFECTS SHRIMP QUALITY

MECHANIZED SHRIMP PEELING

2.00

lots 4, 5, 6, and 7 after 7 and 15 days of storage in ice.

Methods. -- Changes in melanosis, bacterial count, pH, organoleptic score, and sweetness were used to measure the effect of holding shrimp in high temperature air prior to storage in ice.

Bacterial results. --Shrimp in lot 2 that were held for 2 hours at 79° to 84° F. before being iced showed 2 to 3 times as many bacteria after 6 days of storage in ice as did shrimp in lot 1 (controls) that were iced immediately after they were caught. After 11 days of storage in ice, the bacterial count of the shrimp in lot 2 was 2 to 3 times that of the shrimp in lot 1. Shrimp in lot 3 that were held for 6 hours before they were iced showed 5 times the bacterial count of shrimp in lot 1 after 6 days storage in ice and 70 times the bacterial count of shrimp in lot 1 after 11 days storage in ice. The bacteriological quality of these samples was substantiated by organoleptic analyses of quality and by changes in pH. When the pH of the shrimp reached 7.7 the characteristic sweet flavor of fresh shrimp had completely disappeared. Therefore, pH is suggested as a reliable index of quality on the basis of these studies and previous studies.

Melanin formation results. -- Shrimp in lot 2 that were held for 2 hours at 79° to 84° F. before being iced showed 4 times as many severe black spots after 11 days storage in ice as did shrimp in lot 1 (controls). Shrimp in lot 3 that were held for 6 hours at 79° to 84° F. before being iced showed 7 times as many severe black spots after 11 days storage in ice as did shrimp in lot 1.

Bacteriostat and antioxidant results. -- CTC with isoascorbic acid had little effect on the retention of quality of shrimp in lots 5 and 7 as indicated by pH or organoleptic analyses. Shrimp in lots 5 and 7 that were held at 79° to 84° F. for 2 hours showed no organoleptic difference in quality after 15 days storage in ice irrespective of the chemical treatment given. CTC did retard to a small degree the rise in bacterial count in lots 5 and 7. Isoascorbic acid was somewhat more effective in retarding melanosis (1) in shrimp in lots 5 and 7 during the 7-day period of storage in ice than in shrimp in lots 5 and 7 during the 15-day period of storage in ice and (2) in shrimp in lot 5 than in lot 7.

2.3

metal rollers that loosen and separate waste from the meat. Water is used in each unit at the rate of 10 gallons per minute, and each unit is driven by a ¾-horsepower motor. Shrimp discharged from the waste separators are flumed to and discharged upon a 40-foot inspection belt.

Deveining. --Three side-by-side deveining machines are used in the Biloxi plant. Shrimp are delivered to the deveiners by screw conveyors from which they drop onto sharp knife blades positioned in an inclined stainless-steel pan. These blades slit the back of the shrimp preparatory to deveining. Removal of the vein is accomplished in a rotary reel in which the veins are engaged in perforations, removed, and washed by jets of water supplied at the rate of 20 gallons per minute. Shrimp meats from the deveiner are flumed into a surge tank from which they are elevated hydraulically by a 3-inch-diameter plastic pipe and discharged onto the mesh conveyor of a continuous blancher.

Blanching. --The blancher consists of a 1½- by 1½- by 24-foot galvanized metal trough with a 12-inch-diameter worm screw driven by a variable speed motor. The blanching time is determined by the speed of the worm screw and ranges from 2 minutes for the small shrimp to 3 minutes for the large shrimp. Blanching is accomplished in a 27° salimeter brine that is heated to from 208° to 210° F. with steam coils that are attached to the sides of the blancher. Upon being discharged from the blancher, the shrimp are graded for size by the use of a stainless-steel vibrating plate, canned, heat processed, labeled, and cased.

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	Millions of pounds			
	Present stock	Canada	Utilization others	Total
Groundfish (continued)				
Butter sole	25.0	1.0	0.0	1.0
Dover sole	40.0	0.7	0.6	1.3
Gray cod	53.0	4.6	6.2	10.8
Lingcod	120.0	3.9	2.3	6.2
Rockfish (10 spp.)	30.0	0.9	8.1	9.0
Blackcod	14.0	1.3	2.7	4.0
Other trawl species	20.0	0.7	0.9	1.6
Scrapfish (10 spp.)	40.0	2.4	1.0	3.4
Dogfish	600.0	5.3[2]	3.0[2]	8.3[2]
Smelts	..	0.4	..	..
Anchovy	25.0	0.2	..	..
Crabs	7.5	3.7	1.2	4.9
Shrimps and Prawns	5.0	1.1	0.0	1.1
Molluscs			0.0	
Pacific oyster	cultured	80,000 U.S. gal.	0.0	80,000 U.S. gal.
Butter clam	20.0	3.5	0.0	3.5
Razor clam	..	0.2	0.0	0.2
Little-neck clam	3.0	0.8	0.0	0.8
Whales	..	610	..	610
Fur Seals	1,855,000	13,100	58,400	71,500
Sea Lions	12,500	90-100	..	..
Seaweeds	3,000.0	0.0	..	..

1/ An additional 650,000 lb. are estimated to be taken annually in subsistence and sport fisheries.
2/ Utilization expressed in terms of weight of whole fish caught, although only the livers are landed.

2.01 (Cross Reference: 0.5, 1.2)

From the author's work, he concluded that herring oil modifies the production of the color, for a redder color was obtained if oil was excluded from the growth. When abundant oil well mixed with salt was present, the color was that of rusty iron.

In summarizing his findings, the author points out that the growth of the red organism is favored by warm temperatures and that the organism is salt-loving and requires free oxygen, which is indicated by the fact that it does not grow below the surface of brine.

3.12 USE OF ANTIBIOTICS FOR THE PRESERVATION OF FISH AND SEA FOODS

Boyd, J. W.; Bluhm, H. M.; Muirhead, C. R.; and Tarr, H. L. A.
American Journal of Public Health 46, (December 1956)
Studies 1956, from the Fisheries Research Board of Canada, FRB No. 466

During the past year there has been an important development in the controversial subject of the use of antibiotics in foods. The U. S. Food and Drug Administration has permitted treatment of eviscerated poultry with CTC, and the American Medical Association has indicated the harmlessness of such treatment. Research concerned with possible industrial applications of CTC has proceeded actively in several laboratories. Subjects such as addition of the antibiotic to flake ice, its distribution in block ice, and other modes of application, such as by use in dipping solutions, or in refrigerated sea water, have been studied. During the past year this laboratory has carried out extensive commercial trials with block ice containing CTC and the results have been very favorable, though really adequate sampling of large vessel loads of fish has not proved practicable. The results obtained in one such trial have been recorded.

The search for antibiotics or other substances which could prove valuable in preventing microbiological spoilage of fish or fish waste products is continuing, and the results of trials with several new antibiotics and furan derivatives are presented. It has been argued that suppression of the natural bacterial flora of fish by introduction of CTC might create favorable conditions for growth of food poisoning organisms should these be present, but these studies indicate that this is unlikely to occur with C. botulinum Type E and with enterotoxigenic staphylococci. There is undoubtedly room for further work along these lines, particularly with shellfish. In conclusion, it is important to refer to the question of CTC residues in fish flesh. All available published information suggests that these

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Authors' summary

3.5 BACTERIA BROUGHT INTO BRINES ON FISH

Liston, J. and Shewan, J. M. (Torry Research Station, Aberdeen, Scotland)
Proceedings of the Second International Symposium on Food Microbiology 1957, The Microbiology of Fish and Meat Curing Brines, pp. 35-43 (1958) (London, England)

Fish taken directly from the sea usually carry no more than a few thousand bacteria per square centimeter of skin and gill area. The dressing and washing operation, if efficiently performed, may reduce this load even further.

After the cleaning process, however, fish usually are stored in crushed ice, and in a few days, the number of bacteria on the surfaces of the fish rises quite rapidly. For this reason it is obvious that the duration of storage prior to brining is important in determining the number of bacteria brought into the brine by the fish.

Before white fish are brined they usually are filleted or split open. The actual procedure used in this operation determines to a large extent the number of bacteria that actually pass into the brine. Even in quite stale fish (12 to 14 days in ice) the numbers of bacteria actually in the flesh are much less than on the skin. During the preparation of skinned fillets, however, bacteria are transferred to the flesh from the skin by the way of the knives and filleting boards. Since the transfer of bacteria from the skin is so large, the contamination from land sources can be considered to be negligible.

The bacterial population of split fish probably does not differ appreciably from that of whole fish, since any bacteria rubbed off on benches and knives are returned largely to the exposed flesh surface. The removal of the gills and head, however, undoubtedly reduces the number of bacteria transferred to the brine with the fish.

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ABSTRACTER: Kathryn L. Osterhaug

3.337 THE PIGMENTS OF OFF-COLOR COOKED TUNA MEAT

Brown, W. Duane; Tappel, A. L.; and Olcott, H. S. (University of California, Davis and Berkeley, California)
Food Research 23, 262-268 (May-June 1958)

Introduction. --The pink pigment that appears in precooked tuna and in commercially canned tuna has been characterized as a hemochrome by Brown and Tappel (1957). Occasionally tuna fish fails to develop a normal pink color and instead takes on a tan to tannish-green color. These tuna are referred to in the industry as green tuna and are rejected. Green tuna represent a loss both to the fishermen and to the tuna canner because they must be handled, cooked, and trimmed before the off-color becomes apparent. Similar color problems have occurred in cured meat products.

Purpose. -- This paper reports studies made to determine the chemical properties of the pigments that are responsible for green tuna.

Experimental. -- Samples of raw and precooked tuna loins from normal and green tuna were obtained from commercial tuna canneries located in California and were sealed and frozen in ½-pound cans for use in these studies. The reflectance spectra of tuna samples were recorded with a Beckman DR spectrophotometer equipped with a reflectance attachment. Absorption spectra were recorded with the same instrument. Reduction on the surface of the samples of tuna was accomplished by sprinkling a solid reducing agent such as sodium hydrosulfite on the surface of the tuna loin and spreading this material over the loin with a small brush.

Raw, frozen samples of tuna were precooked in the laboratory in the unopened cans by heating to 100° C. for 45 minutes. Small amounts of tuna combined with various additives were precooked by

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ABSTRACTER: Martin Heerdt

3.5 THE BACTERIOLOGY OF SALT USED IN FISH CURING

Bain, Nora; Hodgkiss, W.; and Shewan, J. M. (Torry Research Station, Aberdeen, Scotland)
Proceedings of the Second International Symposium on Food Microbiology 1957, The Microbiology of Fish and Meat Curing Brines, pp. 1-12 (1958) (London, England)

The salt content of cured fish may vary from 2 to 15 percent NaCl. A study of the microbiology of smoked fish must, therefore, include an investigation both of the number and of the type of bacteria contributed by the salt.

Salts commonly used in the food industry belong to three classifications: (1) "manufactured salts," which are obtained by dissolving natural salt deposits, pumping the brine to the surface, and then refining by one of a number of methods; (2) solar salts, which are obtained by the natural evaporation of sea water or other natural brines; and (3) rock salts, natural deposits that occur in various parts of the world and are mined, ground, and marketed without any special purification. All three of these types of salt are used in the fish-processing industry.

Scientists at the Torry Research Station in Aberdeen, Scotland, have undertaken an investigation of the microbiology of salt as it applies to the fishing industry.

Materials and methods. --The solar and rock salts used were from a stock of more than one hundred samples collected from all parts of the world. The manufactured salts examined were supplied by a British chemical company.

The analyses consisted of (1) total viable counts, (2) halophilic and halotolerant counts, and (3) qualitative bacteriological analysis.

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ABSTRACTER: Kathryn L. Osterhaug

3.337 (Cross Reference: 1.12)

placing 10 grams of loin in a clear, glass vial 25 by 95 mm. in size; adding hot, freshly boiled, distilled water; capping; and cooking for 15 minutes at a pressure of 10 pounds per square inch. Compounds added to these vials consisted of 0.01 and 0.1 percent sodium hydrosulfite or sodium ascorbate alone or in combination with 0.01 or 0.1 percent nicotinamide.

Oxidation-reduction potentials of a 1:5 blend of tuna flesh in 0.1 molar phosphate buffer were measured at pH 7.0 with a Beckman Model G pH meter with the aid of platinum and saturated calomel electrodes. During the measurement of the oxidation-reduction potential the sample was held in an air-tight plastic cup equipped with an inlet and an outlet to permit continuous bathing of the sample with pure nitrogen gas. Sulfhydryl groups were determined in tuna flesh homogenates according to the method of MacDonnell et al. (1951) by titrating with standard cysteine the excess p-chloromercuribenzoate remaining after a known quantity was allowed to react with the sulfhydryl groups in the sample.

Results.--Studies of the properties of the pigment responsible for the unusual color in so-called green tuna as well as the numerous measurements of reflectance spectra indicate that the pigment is a hemichrome. This hemichrome could be transformed to the hemochrome by treatment with a suitable reducing agent. The hemichrome appears to result from the absence of proper reducing conditions. Relationships between the off-color condition of the tuna and the manner in which they were handled prior to arrival at the cannery could not be established.

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Results.--From the data collected, the following conclusions were drawn: (1) the number of bacteria from rock and manufactured salts that would grow on ordinary media was never more than 10^3 and averaged about 10^2 per gram; (2) solar salts, when counted on ordinary media, averaged about 10 times that of the other two; and (3) the halophilic or halotolerant types of bacteria were usually absent, or present in very small numbers, in both rock and manufactured salts.

In the solar salts that were examined, the flora on ordinary agar consisted largely of Bacillus and Micrococcus species, whereas in rock salt, Micrococcus species predominated.

3.12

would either be absent or present in negligible amounts in cooked fish. The results of our recent studies on this problem were presented last month at the antibiotic meeting in Washington and it is hoped that they will eventually be published.

3.5

The bacterial flora of the fish is dependent also upon the conditions of storage and handling. Several species of white fish examined immediately after catching were found to have essentially the same overall flora, consisting essentially of gram-positive rods. During storage in ice the Pseudomonas spp. increased and the Achromobacter spp. decreased.

During storage there is a varying amount of mechanical contamination of fish from their surroundings. Corynebacteria, probably derived from ice, constitute the bulk of these adventitious types and small numbers of cocci also appear to be added in this way.

Listed in Table 2 (omitted) are the flora of fresh and stored haddock and of the flesh of split haddock shortly after splitting.

What, in general, is the fate of bacteria brought into brine on fish? Three of the possibilities are: (1) they can be killed during the dipping process, (2) they can be washed off the fish and remain alive as part of the brine flora, or (3) they can survive the brining process and be brought out of the brine still attached to the fish.

The ability of bacteria to grow on media containing high concentrations of salt indicates, presumably, their ability to survive in brine. Experimental results indicate that the incidences of halotolerant bacteria are higher on fresh than on stale fish. However, the actual number of halotolerant bacteria is larger on stale than on fresh fish. Spoiled fish, therefore, obviously will introduce more halotolerant bacteria into brine than will fresh fish.

3.237 COMPOSITION AND CONTROL OF POTATO CHIP FRYING OILS IN CONTINUING COMMERCIAL USE

Melnick, Daniel; Luckmann, Frederick H.; and Gooding, Chester M. (The Best Foods Inc., Bayonne, New Jersey)
Journal of the American Oil Chemists' Society 35, 271-277 (June 1958)

The oils in use on a continuing commercial basis in the production of potato chips on a nation-wide scale are found to be free of thermal polymers. This conclusion is supported by the similarity in physical properties and in chemical composition between the fresh and heated oil in any one operation. In (a) degree of unsaturation of oils, (b) melting point, (c) setting point, (d) fatty acid composition, (e) free fatty acid content, (f) concentration of fatty acid isomers, (g) solids content index, and (h) in the crystallizing properties of the oils, there are no differences between fresh and heated oil of such magnitude to warrant criticisms of the wholesomeness of the oil being absorbed by the chip.

The constancy in composition between heated and fresh oil, particularly with respect to the essential fatty acid content, which is largely responsible for the noncaloric functions of fats in the diet, permits the same conclusions to be made in regard to the nutritive value of the heated oils, i.e., of the triglycerides contained therein, as have been drawn from studies conducted on the corresponding fresh oils.

Based upon statistical quality control considerations, the oils employed in the survey of the potato chip industry have been characterized by having a free fatty acid value of no greater than 0.60% and a decrease in iodine value of no greater than 3.0% in 95% of the operations. These control limits characterize the oils, which, on test, have led to the generalization about the absence of thermal polymers in commercial potato chip frying oils.

Authors' summary

3.5 WHITE CRYSTALS OF SODIUM PHOSPHATE ON SALT FISH

Dyer, W. J.; Fraser, Doris I.; and Dingle, J. R. (Fisheries Technological Station, Halifax, Nova Scotia)
Fisheries Research Board of Canada, Progress Reports of the Atlantic Coast Stations No. 69, 28-32 (May 1958)

Introduction.--Samples of salt fish that had hard powdery white crystals scattered thickly over the surface and in the flesh were obtained from a local salt-fish plant. Analysis showed that the crystals were identical in composition to the air-dried crystals of disodium hydrogen phosphate found in earlier samples.

Solubility of disodium hydrogen phosphate in salt solution.--The solubility of sodium chloride, which is affected very slightly by changes in temperature, is 35.9 grams per 100 grams of water in the range 32° to 68° F., that is, 35.9 parts of salt per 100 parts water (by weight). The solubility of disodium hydrogen phosphate, expressed as parts of anhydrous disodium hydrogen phosphate per 100 parts of water, is about 6 parts at 68° F., 3 parts at 59° F., and only 1.5 parts at 48° F.

Phosphate content of fish.--Ordinary fishery salts contain only a trace of phosphate, whereas fresh cod muscle contains about 0.17 to 0.20 percent phosphorus as inorganic phosphate. If fresh fish tissue contains 81 percent water, then the disodium phosphate in solution in the water of the tissue would be 0.97 to 1.13 parts per 100 parts of water. In undried salt fish, this concentration should remain unchanged since only salt is added during the salting. Some phosphate will be lost in the pickle that is formed, whereas the concentration remaining in the water held by the salt fish will be the same unless some phosphate is held by the tissue. Below 43° F., the solution would be saturated with respect to phosphate, and crystals of the hydrated sodium phosphate would be deposited.

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ABSTRACTER: Martin Heerdt

3.5 THE SALT TOLERANCE OF BACTERIA FROM LIGHTLY SALTED FISH

Dussault, H. P. (Fisheries Technological Station, Grand-Riviere, Quebec, Canada)
Proceedings of the Second International Symposium on Food Microbiology 1957, The Microbiology of Fish and Meat Curing Brines, pp. 61-67 (1958) (London, England)

Information published in recent years in regard to the effect of sodium chloride on microorganisms indicates that high concentrations, from 10 percent to saturation, either retarded growth or stopped it completely, but that low concentrations, from 1 to 5 percent, often caused a slight growth stimulation. The degree of tolerance toward salt is known to be modified by a variety of environmental factors. Several species of bacteria also are able to adapt to salt.

Lightly salted codfish of the "Gaspe Cure" type is a specialty of the east coast of the province of Quebec, Canada. It is characterized by its amber color, its translucent flesh, and its characteristic flavor and aroma, which somewhat resembles that of cheese. The theory is that these characteristics are imparted by the low salt content (18 percent of the dry weight), the prevailing curing temperature, and the local microflora. A bacteriological study, therefore, was made in order to discover the action of bacteria during the preparation of Gaspe cure cod.

Experimental.--The bacterial changes taking place during the various stages of preparation were followed in order to discover how the bacteria originally present on the fresh fish were affected by the salt. Samples of fish from commercial production were taken at intervals and their bacteria cultivated on 3 percent NaCl agar media. Counts were made and various genera of bacteria were identified.

Results.--(1) The total number of bacteria increased rapidly during the two or three days of

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ABSTRACTER: Kathryn L. Osterhaug

3.5 THE BACTERIOLOGY OF BRINES USED IN SMOKE CURING OF FISH

Bain, Nora; Hodgkiss, W.; and Shewan, J. M. (Torry Research Station, Aberdeen, Scotland)
Proceedings of the Second International Symposium on Food Microbiology 1957, The Microbiology of Fish and Meat Curing Brines, pp. 103-116 (1958) (London, England)

In some fish houses, the brine is changed each day whereas in others it may be kept in continuous daily use for as long as two weeks. Brines, therefore, are likely to differ markedly in their bacteriological properties. The work reported in this article is designed to help answer the following questions: (1) Does brining merely contribute to the flavor of the fish or does it affect materially the keeping quality? (2) If keeping quality is affected, how often should brine be changed? Experience indicates that these problems are complicated enough that each component of the salting process must be investigated in order to answer them.

Materials and methods.--The brine used as part of the process of smoke curing finnan haddie, as carried out in a commercial fish house in Aberdeen, Scotland, is prepared fresh each day. An 88-gallon-capacity stock pot is used to mix the brine, which is made from Hamburg salt. The stock brine, 100 percent saturated, is diluted to 75 percent saturation to supply several concrete fish-brining tanks that each hold 28 gallons of brine. Fifty-six-pound lots of fish are placed in the brine for from 7 to 10 minutes, removed by hand, and hung on tenters ready to enter the smoke-kiln. The amount of fish processed per tank per day ranges from 10 to 100 stones (140 to 1400 pounds). The freshly prepared brine is clear and colorless, but during use an accumulation of fish debris renders it cloudy and tends to form a scum on the surface.

Total viable counts were performed on 500 milliliter samples of brine using the pour-plate method. Nutrient agar was used as the basis for media containing 0, 0.5, 5.0, and 10 percent added

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ABSTRACTER: Kathryn L. Osterhaug

salting and then decreased gradually during the subsequent drying operation. Although the bacterial population increased to several million per gram of fish, no putrefying odor appeared during this period. (2) The qualitative analysis of the bacterial population indicated that the genus Micrococcus is predominant and that its proportion increases rapidly during the process of salt curing, ranging from 40 to 90 percent of the total number of bacteria. A simultaneous reduction takes place in the other genera present, which are named in the following order of importance: Flavobacterium, Achromobacter, Pseudomonas, Bacillus, and Sarcina. The genus Micrococcus apparently is able to adapt itself to different concentrations of salt and to develop in its presence.

NaCl. Sea-water agar also was used.

Analyses of the flora were carried out by picking off 50 to 100 colonies at random from each count. These cultures were plated on nutrient agar that had the same NaCl content as the count plate and were examined for colony formation, morphology, and Gram-reaction. Sub-cultures in broth were examined for morphology and motility under a phase-contrast microscope.

Results.--The data reported in this paper are the results largely of two separate experiments. In experiment A, viable bacteria counts were made on brines from a stock tank; from the fish brining tanks before any fish were dipped; and from the brining tanks 3 and 8 hours later after 24 stone (336 pounds) and 53 stone (742 pounds) of fish, respectively, had passed through the brine. In experiment B, brine samples were taken from the fish brining tanks at the beginning of the day's run, when only 4 stones (56 pounds) had been brined, and later when 76 stone (1064 pounds) had been processed.

The flora of the fresh brine was found to be conditioned by the flora of the salt used, but immediately after the first lot of fish had been brined, there was an increase in the bacterial load, which rose steadily throughout the day as more fish were processed. The brine had a selective action on the bacteria brought in by the fish. Pseudomonads, which are predominant on fish, were suppressed and Gram-positive asporogenous rods, (Coryneforms) became the most important group. The brines investigated did not appear to be a major source of contamination of organisms of public health significance.

Contributing factors.--If partial drying of the fish occurs, less water will remain in the fish to dissolve the phosphate. The solution then may become supersaturated, in which case crystals of the hydrated phosphate will be deposited on the surface of the fish since this is where the most drying and the highest concentration will occur. During the winter season, large amounts of the crystals can form because of a decreased solubility of the phosphate at lower temperatures.

A partly dried, heavily salted fish (Lunenberg) having 51 percent water contained the equivalent of 1.92 parts of anhydrous disodium hydrogen phosphate per 100 parts of water. This amount of phosphate would be saturated at about 55° F. Similarly, a medium salt fish (Newfoundland), partially dried and having phosphate crystals on the surface, became saturated with phosphate at 57° F. Disodium hydrogen phosphate forms only under slightly alkaline conditions at pH 7.5 to 8. Most commercial solar salts are alkaline, but the fish itself is usually neutral. If light or medium salted fish was stored under conditions that would permit spoilage to proceed into the initial stages, then the fish probably would become sufficiently alkaline to form the less soluble disodium phosphate hydrate.

The factors that contribute to the formation of disodium hydrogen phosphate on salt fish are: (1) partial drying of the salt fish prior to storage or transportation, (2) low temperature of storage, and (3) a slightly alkaline condition of the fish, such as develops during the initial phases of spoilage. Once the disodium phosphate dodecahydrate crystals are formed on the fish, any subsequent exposure to a dry atmosphere will remove some of the water from the crystals, and a white powdery salt, the dihydrate, will result. This salt is not harmful, and it probably will be removed when the fish are washed. In dried, heavily salted fish, it probably will not be noticed at all.

Decrease in solubility of sodium chloride.--The solubility of sodium chloride in water is 35.9 parts per 100 parts of water (by weight) at 68° F., whereas in the presence of sodium phosphate, it is only 33.8 parts. This explains why salt fish containing 35.9 percent salt cannot be obtained when the solubility data of salt-water systems only are used.

4.10A

24TH ANNUAL REVIEW OF THE LITERATURE ON FATS, OILS, AND DETERGENTS, PART I.

Piskur, M. M. (Swift and Company, Chicago 9, Illinois)
Journal of the American Oil Chemists' Society 35, 208-225 (May 1958)

Economic information and comprehensive literature.--For availability, cost of production, and possible uses besides source and properties, see terrestrial and marine animal oils (Carola--Olii minerali; grassi e saponi colori e vernici 34, 233, 382); oil content, properties of the oil, separation and purification of the wax, unsaponifiable, etc., of sperm whale oil (Fujii, Okura, et al.--Nippon Suisan Kabushikikaisha Kenkyusho Hokoku No. 8, pp. 19, 24, 75, 77, 85, 88, 91, 95); similar information on baleen whale oil (Okura et al.--Ibid. 45, 51, 65, 71); utilization of whale oil (Bezzubor--Masloboino-Zhirovaya Prom. 21, No. 7, pp. 25); and uses for sperm oil (Wahnon--Ing. Chim., Milan 38, No. 205, pp. 107). An article on marine oils gives practical reference data and results on fractional distilling methyl esters of herring oils and indicates how the fractions may be used in various industries (Vandenheuvel and Jangaard--Can. Chem. Processing, Mar. 1957, 40).

Animal and fish fat production.--A comprehensive study of various systems used in rendering whale blubber and influences of particle size, temperature, moisture, etc. indicates that grinding to 2 cm. size, heating under vacuum at 100° until 40 to 50 percent of the moisture evaporates, skimming, and pressing the residue are compatible with good yield and quality of the oil (Golovin--Rybnoe Khoz. 33, No. 6, 85).

Improved separation of oil is attained in rendering herring by buffering to pH 6.3 to 6.5 after boiling to coagulate the proteins (Notevarp--Norw. 88, 486). According to another patent, improved oil separation from boiled herring pulp is obtained by evaporation to 40 percent solids before centrifugal segregation of the oil (Aktieselskabet Limvann--Norw. 89, 580). A laboratory survey of various

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4.10B

24TH ANNUAL REVIEW OF THE LITERATURE ON FATS, OILS, AND DETERGENTS, PART I.

Piskur, M. M. (Swift and Company, Chicago 9, Illinois)
Journal of the American Oil Chemists' Society 35, 208-225 (May 1958)

(Continued from Card 4.10A)

Products.--Rational use of oils and fats in canning of fish (Vershinin--Rybnoe Khoz. 33, No. 4, 84) and in sausage making (Gruttner and Pfaff--Fleischwirtschaft 9, 107), respectively, are the texts of two communications. The one on fish canning contains practical data on changes in characteristics of oils during the processing and storage of canned fish and suggestions for practical utilization of various oils and fats in different products. The hydrazides of the fatty acids of oils of the hydnocarpus species (Tyoki--Japan 3369-'55) and glycerides of mixed C_8—C_{14} fatty acids (Imhausen et al.--Ger. 842,940, Cl. 120) are said to have tuberculostatic properties. Reviews are written on synthesis of cephalin, phosphatidyl serine, and acetal phospholipides (Malkin--Fette-Seifen-Anstrichmittel 59, 77), of linear, branched, ethylenic acetylenic, hydroxy, and cyclic fatty acids (Gensler--Chem. Revs. 57, 191), and of branched fatty acids (Koch--Fette-Seifen-Anstrichmittel 59, 493). Many α-ω-diaryl fatty acids are synthesized, and their properties are recorded (Oura et al.--J. Pharm. Soc., Japan, 76, 1071). Oleic acid esters of aryloxy alcohols are made for use as intermediates and plasticizers and for use in lubricants (Neely and Rocchini--U. S. 2,809,936). Fatty acid-phosphonic acid compounds are rust inhibitors, lubricant oil modifiers, and insecticide ingredients (Reis--U. S. 2,784,208).

General descriptive communications are written on using cod oil, seal oil, and fatty acids in oil-tanning of leather (Airoldi--Chim. Ind., Milan, 39, 283). Castor, cuttle fish, and soybean oils polymerized under the influence of silent electrical discharge are suited for manufacture of coating materials (Gotoda--J. Electrochem. Soc., Japan 24, 177, 313). "Polyol" compounds are added to

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24TH ANNUAL REVIEW OF THE LITERATURE ON FATS, OILS, AND DETERGENTS, PART II.

Piskur, M. M. (Swift and Company, Chicago 9, Illinois)
Journal of the American Oil Chemists' Society 35, 288-316 (June 1958)

Nutrition, physiology and biochemistry.--Rats fed fatty alcohol esters of sperm whale oil or sperm whale oil containing the fatty alcohol esters suffer from seborrhea and succumb; whereas the glycerides of this oil are digested as easily as butterfat (Fujii and Okura--Nippon Suisan Kabushikikaisha Kenkyusho Hokoku No. 8, pages 35, 39).

Composition and characteristics.--A method for determining fat in whale meat on board ship involves a hydrochloric acid hydrolysis, taking up fat with 1 : 1 mixture of ether : hexane, and measurement by saponification with standard alkali followed by back titration with standard acid (Benterud--Norsk Hvalfangst-Tidende 45, 511). Extraction with straight acetone or acetone containing one percent hydrochloric acid gives high results on fish meals because nonlipide material is extracted with the fat (Montequi and Pineda--Bol. inst. espan. oceanog. No. 78-79, 13 pp.).

Chromatographs of dolphin, whale, and mixed fish oils prepared with iso-butanol, fluoresce, whereas those of butter and cacao butter do not (Cerutti--Latte 29, No. 12, 3).

Various chemical and physical characteristics are recorded for liver oil of gad fish, Laaemonema morosum (Komori et al.--Abura Kagaku 5, 284).

The sterol fraction of the fat of many fishes has been fractionated, some of the sterols identified, and some as yet unidentified constituents are described with respect to some of their physical and chemical characteristics (Toyama et al.--Nippon Kagaku Zasshi 75, 1238, 1241; 76, 236, 240, 243;

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4.13

THE COMPOSITION OF THE FATTY ACIDS LIBERATED FROM THE PHOSPHOLIPIDS IN THE PREPARATION OF SALTED CODFISH

Cardin, A.; Bordeleau, M. A.; and Laframboise, A. (Fisheries Technological Station, Grande-Riviere, Quebec)
Journal of the Fisheries Research Board of Canada 15, 555-558 (July 1958)

Purpose.--In the present study, the authors determined the amount as well as the kind of unsaturation of the various fatty acids liberated from the phospholipids of cod flesh during the preparation of light salt codfish. These fatty acids were determined before and after salting, or in the fresh fish as well as in the light salt "Gaspe cure."

Experimental.--Gaspe cure codfish were prepared by using 8 pounds of salt with each 100 pounds of split codfish. Codfish were held for 48 hours in salt, removed from the salt, and dried in three stages to 38 percent moisture.

One hundred-gram samples of codfish flesh from both fresh and cured fish were extracted successively by refluxing for 4 hours with 200 milliliter portions of acetone, ethyl alcohol, and petroleum ether (boiling point 40° to 60° C.). After the acetone and alcohol extracts had been freed from the solvents, the aqueous residues that were obtained were re-extracted with petroleum ether. A lipid extract was obtained that is estimated to be representative of the total lipids present in the flesh and to be free from nonlipid material. This lipid extract was dissolved in ether. Phospholipids were separated from it by means of three successive over-night precipitations with 10 volumes (wt./vol.) of acetone at 0° C.

The phospholipids obtained from these extracts were hydrolyzed by refluxing with 1 percent sulfuric acid in ethanol for 3 hours and by refluxing with 7 percent potassium hydroxide with ethanol for 2 hours to prevent rearrangement of the highly unsaturated acids. The resulting mixture was acidified, and fatty acids were obtained by successive crystallization in 10 volumes (wt./vol.) of

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ABSTRACTER: Martin Heerdt

REVIEW OF FATS AND OILS, 1957 (CARD 1)

REVIEW OF FATS AND OILS, 1957 (CARD 2)

REVIEW OF FATS AND OILS, 1957

FATTY ACID COMPOSITION OF SALT FISH

4.10B

grease containing some lead soap and menhaden oil to raise the Timken test values (Langer--U. S. 2,785,130). In another extreme-pressure grease, part of the gelling soaps are lead soaps of fish oils (Fainman and Swenson--U. S. 2,790,770). The novelty of two greases containing lithium fish oil soaps pertains to special mineral oil components (Bartlett et al.--U. S. 2,801,970).

Emulsions for lubricating textiles for spinning contain mineral oil and a combination of bodied sperm oil, alkyl phosphate, dibutyl ethanolamine, and a nonionic surface active agent (Fortess et al. --U. S. 2,810,692).

Deterioration of fatty materials.--In the autoxidation of cuttle fish oil exposed to air, the peroxide value reached a maximum in 25 days and conjugated dienoic acids increased up to 25 days, whereas higher unsaturates decreased and the amount of sesamol and sesamolin remained unchanged for 50 days (Oikawa--Kagaku to Sosa 9, 15).

Stabilized fish oils are produced if the fish are cooked in antioxidant solution in the rendering process (Matsuhashi--Japan 3929-'56).

4.10A

techniques for production of high-quality vitamin A oil from cod liver indicates that steaming the livers in water and centrifuging at 85° to 90° is most practical in the compromise between yields and quality (Kempa and Tomaszewska--Przemysl Spozywczy 9, 271).

Winterizing, splitting, and fractionation.--Furfurol extraction technique is demonstrated on linseed, turtle, cod liver, avocado, and sweet almond oils, giving the characteristics and vitamin A content of the fractions and suggesting application for the fractions (Rovesti--Riv. ital. essenze profumi, piante offic., oli vegetali, saponi 38, 547). Ternary systems of cod-liver oil--fatty acids--furfural and cod-liver oil--furfural are discussed in regard to segregation of a high iodine value fraction and fractions high in vitamin A (Lopez--Anales real espan. fis. y quim. 52B, 207).

Fatty acids are converted to the cyclohexylamine or benzylamine salt in a technique used to separate palmitic acid from the fatty acids of animal, vegetable, or marine oils (Magne et al.--U. S. 2,781,596).

The urea precipitation technique is applied to the wax alcohols and fatty acids of sperm whale oil, and data is recorded as a basis for applying the method to this oil (Abe and Watanabe--Yushi Kagaku Kyokaishi 3, 164; Ibid. 5, 152, 349).

The unsaponifiable matter of shark-liver oil contains oleyl alcohol as the chief component and has been steam distilled to yield a relatively pure oleyl alcohol product (Mitsunaga et al.--Aubura Kagaku 5, 355).

The accumulation and disappearance of tri-, di-, and monoenoic and the disappearance of tetra-, penta-, and hexaenoic acids are recorded during the course of hydrogenation of sardine oil with 2 percent nickel catalyst at 180° (Takeda and Toyama--Abura Kagaku 6, 10).

(Continued on Card 4.10B)

4.13

acetone or ethyl ether at low temperatures.

The fractions obtained by crystallization were converted into methyl esters, and these esters were fractionally distilled. To determine the saponification equivalent of the methyl esters, 0.2-gram samples were dissolved in absolute ethyl alcohol and titrated with alcoholic hydrochloric acid under a constant atmosphere of carbon dioxide-free nitrogen. The composition of each methyl ester fraction was determined from its saponification equivalent and iodine value.

Results.--Fresh codfish flesh contained 3.2 percent total lipids on a dry basis. Of this total lipid content, 67.7 percent was phospholipids that contained 68 percent fatty acids. Gaspe cure codfish flesh contained 3.5 percent total lipids on a dry basis without salt. Of this total lipid content, 17.2 percent was phospholipids that contained 57.5 percent fatty acids. From these values the authors determined that by weight 77 percent of the phospholipidic fatty acids was liberated during the preparation of Gaspe cure codfish. The authors also calculated (1) the percentage by weight of the component fatty acids before and after salting and (2) the proportion as well as the mean unsaturation of each group of fatty acids liberated during salting.

Of the major component phospholipid fatty acids in fresh codfish flesh, both the saturated and unsaturated C_{16} acids were liberated in large amounts during salting. The C_{18}, C_{20}, and C_{22} unsaturated acids were liberated in moderate and in about equal amounts. The C_{20} and C_{22} unsaturated acids represent 57 percent of all of the fatty acids liberated during salting. The mean unsaturation of the C_{20} and C_{22} acids in the phospholipids is lower in salted codfish than in fresh codfish. This fact indicates that the most highly unsaturated acids of these two groups of acids are liberated during salting. The mean unsaturation of C_{22} unsaturated acids is -11.4 H and -11.0 H, respectively, before and after salting. From these data the authors calculated that the C_{22} acids liberated during salting have a mean unsaturation of about -11.5 H. Although 23 percent of the acids liberated are saturated acids, the large amounts and the high unsaturation of the C_{20} and C_{22} acids cause the total fatty acids liberated to have a calculated iodine value of about 239.6.

4.10

Mem. Fac. Eng. Nagoya Univ. 7, 1, 145, 151, 156; 8, 29, 35, 40). In many instances in this work the fatty acid composition of the fish fat is also reported.

Analytical data on the phosphorus, nitrogen, choline ethanolamine and the fatty acid composition of the phosphatides of the heart of rorqual, pollacks, brain of sperm whale, eggs of pollacks, eggs of crabs, and brain of rorqual are recorded (Igarashi et al.--Nippon Nogei-kagaku Kaishi 30, 111, 116, 433, 435, 566, 568; 31, 4, 8, 582).

The liver oils produced from fish that were contaminated with radioactive material from atomic and hydrogen bombs have no significant radioactivity (Nagasawa et al.--Eisei Shikenjo Hokoku No. 74, page 231).

6.193 FISH BYPRODUCTS IN FEEDS

Bird, H. R. (University of Wisconsin, Madison)
Feedstuffs 30, 79-80 (July 5, 1958)

The distinctive value of fish solubles lies in its unknown vitamin-like factor, and the distinctive values of fish meal are its unknown factor and high quality protein. These values are the basis for the recommendation that fish meal or solubles be used in all broiler, starting and breeder mashes.

The unknown factor is a difficult thing to study. There has been difficulty in getting reproducible results. The reasons for the variable response to fish products are not well understood. In our experiments, cleanness or contamination of the environment appears to be an important factor.

Twenty different fishery byproducts, some commercial and some experimental, were compared with a standard sample of fish solubles. Their potency varied, but all samples contained measurable quantities of unknown growth factor.

From further work, it appears the factor is quite stable to overheating and to long storage. In our experiments, the factor was destroyed by ashing. Furthermore, a combination of molybdenum, zinc, and selenium had no effect on growth in our assay.

Adding a fish meal of good quality to all-vegetable protein basal diets improved growth and feed efficiency. Adding over-heated experimental meals depressed growth and feed efficiency.

At recent wholesale prices, the value of nutrients furnished by 100 lb. of fish meal was determined and compared with the selling price of fish meal. (The figures covered protein, energy,

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7.51 MODIFICATION OF PEPSIN-DIGESTIBILITY METHOD FOR ANIMAL PROTEINS

Gehrt, Albert J.; Caldwell, M. J.; and Elmslie, W. J. (Moorman Mfg. Company, Quincy, Illinois)
Journal of the Association of Official Agricultural Chemists 40, 606-617 (1957)

This study is concerned with two modifications in the pepsin-digestibility method Gehrt (1955). Each modification is the basis for a new method. For convenience, the original method will be called method one, the first modification will result in the formation of method two, and the second modification will result in the formation of method three.

Method two. --After defatting and flotation of one gram of meat meal, incubate the lighter than carbon tetrachloride fraction for 16 hours at 50° C. in 50 milliliters of 0.075 normal hydrochloric acid that contains 0.1 gram of 1:10,000 pepsin.

Method three. -- Defat 1 gram of meat meal and incubate the entire sample for 7 hours at 52° C. in 200 milliliters of 0.1 normal hydrochloric acid that contains 0.4 grams of 1:10,000 pepsin. After incubation, add filter-aid, filter off the indigestible residue, and analyze for protein.

Results. --Eight different laboratories took part in the study of protein digestibility by methods one, two, and three. The average values for percent pepsin-indigestible residue that were obtained in the various laboratories are reported below. By methods one, two, and three, respectively, renderers' good quality meat scrap contained 7.5, 6.5, and 13.7 percent pepsin indigestible residue; packers' good quality meat scrap contained 7.5, 6.1, and 9.7 percent pepsin indigestible residue; poor quality meat scrap contained 13.8, 12.9, and 19.6 percent pepsin indigestible residue; and hydrolyzed commercial grade feather meal contained 35.3, 31.2, and 37.4 percent pepsin indigestible residue. Method three was preferred if the assay was made simply to determine the percentage of

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ABSTRACTER: Martin Heerdt

7.81 BIOCHEMICAL METHODS FOR DETERMINING SHRIMP QUALITY
I. STUDY OF ANALYTICAL METHODS

Gagnon, Marcel and Fellers, Carl R. (University of Massachusetts, Amherst)
Food Technology 12, 340-343 (July 1958)

Purpose. -- This study was made to investigate decomposition products in frozen breaded shrimp. The authors hoped to establish a definite relationship between a chemical objective test and the degree of freshness in shrimp products. The chemical test must be simple and rapid to be of value for use in production control and inspection.

Experimental. --Commercially frozen, breaded fantail shrimp packed in 10-ounce packages were stored at -7° F. To induce spoilage, seven 10-ounce cartons of shrimp were selected at random every 24 hours and placed in storage at 38° F. Each carton was opened and sampled aseptically for use in the bacteriological studies, and the remainder of the carton contents was passed through a food chopper for use as sample material for chemical analyses.

Total bacteria counts were obtained by plating out adequate dilutions of the sample with nutrient agar in petri dishes. These dishes were incubated at 77° F. for 3 days, colony counts were made, and the results were expressed as the number of bacteria found per gram of frozen breaded shrimp. Moisture was determined by drying samples for 24 hours in an air oven held at 212° F. Percentage of breading was calculated from the weight of the breaded sample and the weight of the washed and drained sample from which the breading had been removed.

Total nitrogen was determined by the Kjeldahl method and reported as grams of nitrogen per 100 grams of frozen breaded shrimp. Ammonia and other volatile bases were determined and reported as milligrams of ammonia per 100 grams of frozen breaded shrimp. A ratio of the volatile base value to the total nitrogen value multiplied by 100 provided the only suitable chemical objective test.

Organoleptic evaluations were made on the basis of a hedonic scale that ranged between 1, which

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ABSTRACTER: Martin Heerdt

8.8 BIOCHEMICAL METHODS FOR DETERMINING SHRIMP QUALITY
II. SURVEY OF MARKET FROZEN BREADED SHRIMP

Gagnon, Marcel and Fellers, Carl R. (University of Massachusetts, Amherst)
Food Technology 12, 344-346 (July 1958)

Purpose. -- This study was made to test proposed ratio values of volatile base to total nitrogen multiplied by 100 as presented in the previous paper for their effectiveness in the determination of frozen breaded shrimp quality. The results obtained in the previous paper were studied for correlation and statistical distribution in regard to actual quality.

Experimental. -- In all, 144 samples representing 24 plants located in 23 cities throughout the United States were analyzed. Analytical methods used were those described in the preceding paper Each sample was assayed for total bacteria count, moisture, breading, total nitrogen, and volatile base; then the ratio of the volatile base to the total nitrogen multiplied by 100 was computed.

Results. -- Moisture determined in duplicate was found to vary between 56.5 and 78.3 percent with an average of 64.2 percent for all of the samples. No significant relationship was found between the moisture and the total volatile bases content of the samples.

Breading was found to range between a maximum of 70.3 percent and a minimum of 26.2 percent with an average of 50.8 percent. A high percentage of breading in a sample appeared to induce a low total nitrogen content. No significant correlation was found between the volatile base content and the amount of breading. Logarithms of the total bacteria counts did not show any significant correlation with volatile base content. Variations in the logarithm of the total bacterial count fell within the range 4.33 to 7.74 with an average value of 5.88. Some samples of good organoleptic and biochemical quality had high bacterial counts, whereas some samples of poorer quality had low

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ABSTRACTER: Martin Heerdt

FACTORS IN FISH MEAL

METHODS FOR PEPSIN-DIGESTIBILITY

ASSAY FOR SHRIMP QUALITY

SURVEY OF SHRIMP QUALITY

7.51

indigestible protein in the sample. Method one or method two was preferred if the identity and quantity of indigestible residue was desired because these methods permit preliminary fractionation by flotation and subsequent microscopy of the residues.

8.8

bacterial counts. Use of the total bacteria count as a criterian of quality in heterogeneous samples of frozen breaded shrimp does not appear feasible.

Total nitrogen values ranged widely from a low of 1.8 to a high of 3.06 grams per 100 grams of frozen breaded shrimp because of variations in the percentage of breading on these samples. Positive correlation significant at the 1 percent level existed between the total nitrogen and the volatile base content of the frozen breaded shrimp.

The volatile base content of the samples ranged from a minimum of 0.094 to a maximum of 0.187 grams per 100 grams of frozen breaded shrimp. Volatile base values alone were qualitatively indicative of the quality of the sample in a group of heterogeneous samples but not of an isolated sample.

The ratio of volatile base values to total nitrogen values multiplied by 100 ranged between 4.5 and 12.8. On the basis of this ratio 17.4 percent of the samples, or those that were of very good quality, had a ratio value of less than 6.0; 47.2 percent of the samples, or those that were of good quality, had a ratio value that ranged between 6.0 and 7.5; 25.0 percent of the samples, or those that were of questionable quality, had a ratio value that ranged between 7.5 and 8.5; and 10.4 percent of the samples, or those that were unacceptable, had a ratio value in excess of 8.5.

6.193

calcium, phosphorus, riboflavin, niacin, pantothenic acid, choline, vitamin B_{12} and "extra" methionine. Subtracting the total value of these nutrients in 100 lb. of fish meal from the selling price leaves the monetary value of the growth factor, other amino acids, etc.)

We started out by saying that the distinctive values of fish meal were high quality protein and unknown factor. The protein and "extra" methionine it contains account for almost half the money value of fish meal. Energy, phosphorus and growth factor also make substantial contributions, and the growth factor is especially important because of the uncertainty as to whether other growth factor sources supply as much "fish factor" as fish products supply. So we have provided an estimate of the value of the unknown factor, and we have provided a basis for the recommendation that some fish meal or fish solubles be used in all broiler, starting and breeder mashes. The figures show that the nutrients in fish meal make it a good bargain even at a rather high price.

7.81

means "like extremely well", and 10, which means "decomposed." Shrimp for organoleptic evaluation were allowed to thaw until they could be separated easily. Then they were cooked for 2 to 3 minutes in preheated vegetable oil held at 365° F., drained, and judged while still hot.

Results. -- The results obtained in this study are tabulated below.

Effect of storage at 3° C. (38° F.) on the chemical bacteriological and organoleptic determinations on a lot of frozen breaded shrimp 1/ 2/

Storage time hours	Average taste panel score 3/	Log of total bacteria per gram	Moisture	Total nitrogen	Volatile base (VB) calcd. as NH_3	Ratio of VB to total N X 100
			%	g./100 g.	g./100 g.	
0	2.2	5.91	63.2	1.88	0.116	6.2
24	3.0	5.36	64.5	1.77	0.122	6.9
48	3.3	5.72	63.4	1.76	0.131	7.4
72	3.9	5.58	63.9	1.73	0.128	7.4
96	4.2	6.10	60.9	1.77	0.129	7.3
120	5.0	5.92	62.4	1.75	0.126	7.2
144	6.2	8.30	62.7	1.77	0.150	8.5
168	5.2	7.63	63.5	1.76	0.135	7.7
192	5.5	8.46	62.0	1.76	0.154	8.8
226	6.3	8.71	62.4	1.75	0.172	9.8
240	10.0	9.35	63.8	1.58	0.158	10.0

1/ All the results given in this table, except for the average taste panel score, were obtained by averaging the results from duplicate analyses of six samples at each storage time.
2/ The average amount of breading for the lot was found to be 47.0 percent.
3/ For the average taste panel score: L.S.D., 5% = 1.09; L.S.D., 1% = 1.38.

6.52 NUTRITIONAL ANAEMIA IN MINK

Helgebostad, A. and Martinsons, E. (Norwegian Veterinary College, Oslo, Norway)
Nature 818, 1660-1661 (June 14, 1958)

Nutritional anaemia in mink has been described by Kennedy (1947) and Whithair et al (1949). In recent experiments we observed that mink kits fed diets containing large amounts of raw coalfish (Gadus virens) developed anaemia and characteristic fur anomalies, especially light under-fur, in about 40 percent of the animals. The same disorder was also seen in mink kits fed diets containing raw whiting (Gadus merlangus). A rather high mortality-rate of about 20 to 30 percent was noted in the anaemic animals. Development of anaemic symptoms and light under-fur could be totally prevented by replacing the dietary raw fish with boiled fish of the same species. The results obtained suggest a heat-labile factor capable of producing anaemia, probably an enzyme in the raw fish.

Investigations at this Research Station have shown the high frequency of anaemia in mink to be related to the feeding of certain species of raw fish belonging to the family Gadidae, especially coalfish and whiting. Other species belonging to Gadidae have not hitherto been investigated. Various species of raw marine fishes (salt-water fish, ocean fish) which have been fed, such as lumpsucker (Cyclopterus lumpus), blue halibut (Reinhardtius hippoglossoides), and catfish (Anarrhicas lupus), produced neither anaemia nor symptoms of light under-fur.

These observations are based on feeding experiments with 350 mink. Forty out of ninety standard mink developed anaemia on an experimental diet with the following percentage composition: raw gutted coalfish (71), stockfish (10.6), dried skimmed milk (2.2), tallow fat (3.5), wheat starch (10.6), bone meal (1.4) and McCollum salt mixture (0.7). In addition, each animal received 1,500 I.U. vitamin A, 150 I.U. vitamin D, 0.7 mgm. aneurin, 2 mgm. α-tocopherol and 0.25 mgm. vitamin K

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 Reprinted in whole

8.64 THE B-VITAMINS OF COD AND HADDOCK

Hoogland, P. L. (Fisheries Technological Station, Halifax, Nova Scotia)
Studies 1956 from the Stations of the Fisheries Research Board of Canada, FRB No. 439, 4 pp.

Purpose. -- This study was made to learn (1) how cod and haddock compare with other protein foods in regard to their content of B-vitamins and (2) the effect of freezing, smoking, and storage on the B-vitamin content of cod and haddock.

Materials. --Materials used in this study were samples of fish flesh obtained from Atlantic cod (Gadus callarias) and haddock (Melanogrammus aeglefinus) within 12 hours after these fish were caught. The materials included commercial fresh fillets obtained from good quality fish, commercial frozen fillets, and commerical smoked fillets. Frozen or smoked fillets used in this study were packed in waxed paper boxes and stored at 0° F.

Methods of analysis. --All vitamins were determined by microbiological assay. Thiamine was determined with Lactobacillus fermentum 36 according to the method and medium of Sarrett and Cheldelin (1944). Riboflavin was determined with Lactobacillus casei e according to the method described in "Methods of Vitamin Assay" (1951) and with the aid of Difco's riboflavin assay medium. Niacin was determined with Lactobacillus arabinosus 17-5 according to the method described in "Methods of Vitamin Assay" (1951) and with the aid of Difco's niacin assay medium. Pantothenic acid was determined by the same method that was used for the determination of niacin except that a pantothenic assay medium was used. Vitamin B_{12} was determined with Lactobacillus leichmannii according to the methods of Truscott, Gage, and Hoogland (1954) and with the aid of the medium of Peeler, Yacowitz, and Norris (1949).

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 ABSTRACTER: Martin Heerdt

8.59 BLOOD GLUCOSE OF THE CRAB HEMIGRAPSUS NUDUS

McWhinnie, Mary A. and Scheer, Bradley T. (De Paul University, Chicago, Illinois, and University of Oregon, Eugene)
Science 128, 90 (July 11, 1958)

Introduction. --Studies of blood reducing substances in crustaceans commonly referred to as "blood sugar" have been numerous. Until recently, however, no means have been available for establishing that the values obtained actually represent glucose, or any other single substance. Attempts to increase specificity by use of Kleinholtz and Little (1949) and Scheer and Scheer (1951) fermentation methods still leave some question; however, they indicate clearly that a substantial fraction of the reducing substances is not glucose. Recently Hu (in press), using chromatographic methods, has shown that acid extracts of the shore crab Hemigrapsus nudus contain a variety of carbohydrates, some of which probably will be present in the blood.

Purpose. -- This study of carbohydrate metabolism in crustaceans was made to learn whether glucose is actually present in normal blood and, if so, at what levels of concentration.

Experimental. --Crabs (Hemigrapsus nudus) were collected near Charleston, Oregon, and brought to the laboratory in Eugene, where they were maintained for 5 to 10 days after capture in sea-water aquaria until blood was drawn. The stage of the animals in the intermolt cycle was determined by the method of Drach (1939), as modified for this species by Kincaid and Scheer (1952). Blood was drawn with a syringe through the coxal membrane of the fifth walking leg and was deproteinized by being heated for 15 to 30 seconds in a boiling water bath. Control experiments with other methods of deproteinization showed that this procedure gave reliable glucose values. Because of the very low glucose concentrations found, the authors preferred to avoid the dilution involved in other

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 ABSTRACTER: Martin Heerdt

9.4 TWENTY-FIVE YEARS OF RESEARCH AND SERVICE BY THE SEATTLE TECHNOLOGICAL LABORATORY

Stansby, Maurice E. (Fishery Technological Laboratory, Seattle 2, Washington)
Commercial Fisheries Review 20, 7-17 (May 1958)

In this report, the activities and accomplishments of the Seattle Fishery Technological Laboratory during its 25 years of operation are reviewed, and the current organization and programs are described.

Activities. -- During the prewar period (1933-1941), the program of the Seattle Technological Laboratory dealt with utilization of salmon waste and fish livers in the production of fishery industrial products, and later the program included limited investigations on the composition and preservation of fishery products. Significant during this prewar period were development of the Laboratory and establishment of good relationships with the fishing industry, in addition to the accomplishments of research.

During the wartime period (1942-1946), programs concerned with wartime problems were undertaken, including work on dehydration of fish, substitute containers for tinplate, seaweed substitutes for agar, and better utilization of certain species of fish; assistance to the Army Quartermaster Corps; and assistance to other wartime agencies. As much of the assistance to government agencies consisted of developing standards and analytical methods to facilitate government purchases of vitamin A oils and livers, the vitamin A project became the largest one in the Laboratory.

Considerable emphasis during the postwar period (1947-1954) was placed on assisting industry to solve problems in freezing and cold storage of fish. A large program was carried out toward better utilization of Alaska salmon waste from the Alaska salmon canning industry; work was done to determine the content of vitamin B_{12} and unidentified growth factors in fish meal; and problems involving storage life of halibut and salmon steaks cut from frozen, stored fish were worked on in

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 ABSTRACTER: June H. Olden

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methods. In addition, most of the other methods of deproteinization render the blood unsuitable for enzymatic procedures. Glucose was determined by the highly specific hexokinase-glucose-6-phosphate dehydrogenase (Zwischenferment) method of Le Page and Mueller (1949), which depends on a spectrophotometric measurement of triphosphopyridine nucleotide reduction in the presence of adenosine triphosphate.

Results. -- The mean blood glucose values for the various intermolt cycle stages, for normal animals and for animals from which eyestalks had been removed 1 to 4 days before collection of blood have been summarized. The values obtained show that the blood glucose of these crabs is very much lower than previous values for blood reducing substances in crabs. Parallel measurements of reducing substances in these crabs were not made; but determinations made by the method of Folin-Wu give values of about 15 mg. per 100 ml., and determinations of "total carbohydrate" made by the anthrone method of Roe (1955) give values of about 10 mg. per 100 ml. The findings indicate that less than 20 percent of the "blood sugar" is glucose.

Variations in blood sugar during the intermolt cycle also are of interest. Renaud (1939) and other workers of this early period found a gradual increase in blood-reducing substances in Cancer pagurus as the molt approached. The authors had very few animals available in the premolt stages, and these showed no sign of a premolt increase in blood glucose. Maximum values appeared in the early intermolt period, and the mean for this stage is significantly higher than the mean for the postmolt or intermolt stage, at a probability level of 0.5 percent on the basis of the t test.

The values for eyestalkless animals are, in general, lower than the values for normal animals in the same stage of the cycle; however, the differences are not statistically significant. Scheer and Scheer (1951) found a decrease in total and fermentable reducing substances in spiny lobsters and were able to explain the differences as the result of an increased tissue utilization of glucose in eyestalkless animals. Kleinholz and Little (1949) and Abramowitz et al. (1944), however, could find no such decrease in reducing substances in crabs.

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cooperation with industry. Investigation was made on composition and cold-storage life of fresh-water fish, and work was started to study the causes of the wide variation in nutritive value among different batches of fish meal and to develop a chemical method of determining the nutritive value of fish meal. Investigation was started on the possibilities of preparing potentially valuable chemical derivatives from fish oil.

Programs of the current period (1955-1958), carried out under funds provided by the Saltonstall-Kennedy Act of 1954, have been in the following fields: fish meal, fish oil, standards, irradiation, tuna handling, and rockfish utilization. A substantial portion of these investigations have been basic research. Other programs deal with determination of chemical composition and with the freezing and storage of fish.

Accomplishments. --A total of 267 papers has been published, about half of them being concerned with analytical methods, frozen fish, and processing of fish meal and fish oil.

Among the most important achievements are (1) aid in development of methods of extracting oil from salmon trimmings to be added back to the canned salmon, (2) work on chemical properties of salmon oils, (3) project on vitamin A, (4) conception, setting up, and continuing preparation of Commercial Fisheries Abstracts, (5) utilization of Alaska cannery waste, (6) proximate composition and cold-storage life of fresh-water fish, and (7) determination of oil in fish meal. Work carried out for the U. S. Customs Service saved the Federal Government an estimated $8 million.

Current activities. --An important function of the Laboratory is the dissemination of information through written bulletins and papers, answers to written inquiries, consultation with persons in the fishing industry, and meetings to discuss research findings and industrial problems. The personnel of the Seattle Laboratory are divided among four sections: basic research, applied research, special services unit, and administrative unit. The activities of the Laboratory are organized under: (1) control of chemical alterations in fish and fishery products during storage and processing (includes all basic research projects), (2) preservation and processing of fish and shellfish, (3) development of voluntary standards of grade for fish and fishery products, (4) services of Special Services Unit, such as preparing Commercial Fisheries Abstracts, (5) direct assistance to industry, and (6) assistance to contract research.

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daily. Many of the animals on this diet had reduced appetite, loose stools and did not grow well. The coat was very dull in appearance and the under-fur was white or greyish in color, a disorder called 'cotton mink' by farmers. Anaemia developed at intervals during the experimental period from weaning to pelting time of about 5 months: twenty-three out of eighty standard mink fed raw whole whiting developed anaemia and light under-fur.

In control experiments comprising in all thirty mink kits on a similar diet, but in which twenty kits were fed boiled whiting and ten were fed boiled coalfish, no single animal showed signs of anaemia or developed light under-fur. In another experimental group of ten mink kits fed boiled coalfish supplemented with 20 percent raw meat and 2 percent brewer's yeast besides vitamins and minerals specified above, all animals were normal.

The type of nutritionally induced anaemia was characterized by a low erythrocyte count and high leucocyte and moderately elevated reticulocyte counts. Stained blood smears showed aniso- and poikilo-cytosis. The poikilo-cytosis was predominant in the extreme cases of anaemia. The picture of red cells showed a mixture of hypochrome normomacrocytes and hyperchrome macro- and microcytes.

Treatment of anaemic animals with organic preparations of iron brought recovery when administered parenterally twice a week (weekly dose, 16 mgm. organic iron). After ten days there was a definite increase in the haemoglobin level, which was maintained for several weeks after the treatment had been discontinued. Oral doses of 40 mgm. iron daily for three weeks gave some relief, although it was not so successful as the parenteral administration. Vitamins of the B complex (aneurin, 1 mgm.; riboflavin, 2.8 mgm.; calcium pantothenate, 10 mgm.; nicotinic acid, 12.6 mgm.; pyridoxin, 1.4 mgm.; folic acid, 0.26 mgm.; biotin, 0.2 mgm.; vitamin B_{12}, 0.01 mgm.; inositin, 10 mgm.; para-aminobenzoic acid, 25 mgm., cholin chloride, 25 mgm.) in big oral doses had little prophylactic effect. Liver extract administered orally or parenterally gave some relief on the anaemic symptoms.

The mink used experimentally were all kept under ordinary farm conditions. Analysis of the coalfish used in our diets gave the following percentages: protein, 18.9; fat, 0.4; minerals, 3.1; dry matter, 22.4. Further studies are in progress.

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The classes of samples on which each of the five B-vitamins was determined in duplicate were as follows: (a) fresh, (b) frozen, (c) frozen and stored for 1 month, (d) frozen and stored for 3 months, (e) frozen and stored for 6 months, (f) smoked, (g) smoked and stored for 1 month, and (h) smoked and stored for 3 months.

Results. -- Evidence has been gathered to show that cod and haddock are reasonably good sources of the B-vitamins. Levels of B-vitamins in cod and haddock were very similar to levels of B-vitamins in beef, pork, and veal. Freezing, smoking, and storage did not affect the average levels of the B-vitamins or result in a loss of B-vitamins. The values obtained for fish as well as for meats are the results of a relatively few determinations. They do not necessarily show the average values that would be found if larger numbers of samples were assayed.

0.5 STUDIES ON SALT FISH IX. EFFECT OF ENVIRONMENT UPON GROWTH OF RED HALOPHILIC BACTERIA

Hess, Ernest
Journal of the Fisheries Research Board of Canada 6, No. 1, 10-16 (December 1942)

(Abstract of this article appears under 3.5 page 9 - October 1958)

0.5 NUTRITION AND METABOLISM OF MARINE BACTERIA II. OBSERVATIONS ON THE RELATION OF SEA WATER TO THE GROWTH OF MARINE BACTERIA

MacLeod, Robert A. and Onofrey, E. (Fisheries Research Board of Canada, Pacific Fisheries Experimental Station, Vancouver, British Columbia)
Journal of Bacteriology 71, 661-667 (June 1956)
Studies 1956, from the Stations of the Fisheries Research Board of Canada, FRB No. 432, 7 pp.

The need of six marine bacteria for sea water in a chemically defined medium has been shown to be due to the ability of sea water to supply the inorganic ions required for growth by the organisms. A supplement of iron in the sea-water medium increased both the rate and the extent of growth of all of the organisms tested.

1.12 AUSTRALIA DEVELOPS TUNA POTENTIAL

Sardone, L. T.
World Fishing 6, 77-80 (October 1957)

(Abstract of this article appears under 1.017 page 1 - March 1958)

1.12 THE STORY OF TUNA

Anonymous
The Tuna Research Foundation
Canner and Freezer 127, 15, 16-17, 28 (July 21, 1958)

2.3 FISH HANDLING AND PRESERVATION II. HYGIENE IN HANDLING FRESH UNFROZEN FISH

Empey, W. A. (Division of Food Preservation and Transport, C.S.I.R.O., Homebush, N.S.W.)
Food Preservation Quarterly 18, 35-38 (June 1958) (Sydney, Australia)

2.3 FISH PROCESSING

Anonymous
Food Manufacture 33, 264 (June 1958)

English patent number 792,651 relates to skinning and boning fish as patented by Birds Eye (Holdings), Ltd. Headed, gutted, and finned fish are blanched briefly at 200° to 225°F; subjected to a high-pressure stream of water, steam, or air to roll back and detach the skin of the fish; and cooked to loosen the flesh from the bones. The flesh then is separated from the bones by a vibrating screen and rinsed.

3.12 CONTROL OF BACTERIAL SPOILAGE OF FISH WITH ANTIBIOTICS

Tarr, H. L. A. (Pacific Fisheries Experimental Station, Vancouver, British Columbia)
Proceedings First International Conference on the Use of Antibiotics in Agriculture Publication 397 (1956)
Studies 1956, from the Stations of the Fisheries Research Board of Canada, FRB No. 438

3.12 ANTIOXIDANTS DO NOT EXTEND STORAGE LIFE OF SHELLFISH

Anonymous
Applied Microbiology 5, 368-372 (1957)
Food Engineering 30, 107 (July 1958)

One-half-pound portions of crabmeat held in cheesecloth bags were immersed for 2 minutes in tap water that contained 5 to 60 mcg. of chlortetracycline or oxytetracycline per milliliter of solution. Five-gallon lots of oysters were blown for 3 minutes in 50-gallon quantities of tap water that contained 5 or 15 mcg. of chlortetracycline or oxytetracycline per milliliter of solution. Decreased bacterial counts were obtained with some of the treatments, but the cold storage life of the treated shellfish was not extended beyond the cold storage life of the untreated controls.

CONVERSION UNITS

1 pound = 453.59 grams
1 ounce = 28.350 grams
1 inch = 2.5400 centimeters
1 gallon = 128 ounces
1 gallon = 231 cubic inches
1 quart = 0.9463 liters
1 ounce = 29.573 milliliters

CONVERSION OF TEMPERATURE SCALES

$F = 9/5\ C + 32$

$C = 5/9\ (F - 32)$

SPECIFIC HEAT AND HEAT OF FUSION

Average values of specific heat generally used for fishery products are 0.80 B.t.u. per pound per °F. above freezing and 0.40 B.t.u. per pound per °F. below freezing.

An average heat of fusion generally used for fishery products is 115 B.t.u. per pound. The heat of fusion of ice is 144 B.t.u. per pound.

DEFINITIONS

calorie ..... heat required to raise the temperature of 1 gram of water 1 degree Centigrade

British thermal unit .....252 calories or the heat required to raise the temperature of 1 pound of water 1 degree Fahrenheit

ton of refrigeration ..... removal of heat at the rate of 12,000 B.t.u. per hour

atmospheric pressure, normal .....a pressure at sea level of 14.696 pounds per square inch, absolute

sensible heat .....heat added to the body when its temperature is changed

latent heat ..... heat absorbed or evolved during a change of state, with no change of temperature

heat of fusion ..... heat absorbed when a solid melts, with no change of temperature

heat of vaporization ..... heat absorbed when a liquid vaporizes, with no change of temperature

heat of reaction ....., heat evolved or absorbed during a chemical reaction

heat transmission .....flow of heat by conduction, convection, or radiation, singly or in any combination

horsepower ..... work performed at the rate of 550 foot pounds per second

mechanical equivalent of 1 B.t.u. of heat ..... heat given off by a total expenditure of 778 foot pounds of energy

COMMON ABBREVIATIONS*

A.	Ångstrom unit(s)
a.c.	alternating current
alc.	alcohol, alcoholic
alk.	alkaline (not alkali)
amp.	ampere(s)
anhyd.	anhydrous
aq.	aqueous
at.	atomic (not atom)
at. wt.	atomic weight
Bé.	Baumé
biol.	biological
B.O.D.	biochemical oxygen demand
b.p.	boiling point
B.t.u.	British thermal unit(s)
cal.	calorie(s)
cc.	cubic centimeter(s)
cm.	centimeter(s)
d.	density (d_{13} specific gravity at 13° referred to water at 4°; d_{20}^{20}, at 20° referred to water at the same temperature)
d.c.	direct current
e.m.f.	electromotive force
Et	ethyl (Et_2O, ethyl ether)
e.v.	electron volt(s)
f.p.	freezing point
ft.	foot, feet
g.	gram(s)
γ	microgram(s)
hr.	hour
in.	inch(es)
kcal.	kilocalorie(s)
kg.	kilogram(s)
kv.	kilovolt(s)
kv.-amp.	kilovolt-ampere(s)
kw.	kilowatt(s)
kw.-hr.	kilowatt-hour
l.	liter(s)
lb.	pound(s)
m.	meter(s); also (followed by a figure denoting temperature) melts at, melting at
M.	molar (as applied to concn.)
ma.	milliampere(s)
Mc.	megacycle
mc.	millicurie
Me	methyl (MeOH, methanol)
meq.	milliequivalent
m.e.v.	million electron volts
mg.	milligram(s)
ml.	milliliter(s)
mm.	millimeter(s)
mγ	millimicrogram
mμ	millimicron(s)
mol.	molecule, molecular
mol. wt.	molecular weight
m.p.	melting point
μ	micron(s)
mv.	millivolt(s)
n	index of refraction (n_D^{20} for 20° and sodium light)
N	normal (as applied to concn.)
petr. ether	petroleum ether
p.p.m.	parts per million
ppt.	precipitate
pptd.	precipitated
pptg.	precipitating
pptn.	precipitation
qual.	qualitative (not qualitatively)
quant.	quantitative (not quantitatively)
r.p.m.	revolutions per minute
sol.	soluble
soln.	solution
sp. gr.	specific gravity
sp. heat	specific heat
sp. vol.	specific volume
sq. cm.	square centimeter(s)
U.S.P.	United States Pharmacopeia
v.	volt(s)
vol.	volume (not volatile)
w.	watt(s)
wt.	weight

* These abbreviations are used by Chemical Abstracts and, accordingly, have wide recognition.

3.239 AUTOLYTIC TRANSFORMATION OF GLYCOGEN AFTER DEFROSTING OF FROZEN MUSCLE TISSUE

Pavlovski, P. E. (Moscow Technological Institute for Meat and Dairy Industry, U.S.S.R.)
Biochemistry (U.S.S.R.) (English translation by Consultants Bureau, Inc., New York, N. Y.) 22, No. 3, 530-535 (May-June 1957)

In all the experiments on defrosting of muscle tissue (both immediately after freezing and after a given period of storage in the frozen state at various negative temperatures), there were established: (1) an intensive breakdown of glycogen, (2) a considerable accumulation of reducing sugars, (3) an intensive accumulation of lactic acid, and (4) an abrupt shift in pH to the acid side.

It was established that the character and rate of the glycolytic and amylolytic processes operating in muscle tissue after defrosting were similar to the changes observed in unfrozen muscle.

The features of the autolytic transformations experienced by glycogen on defrosting and subsequent storage of the defrosted muscle is, in some considerable measure, determined by the volume of the autolytic changes occurring before freezing and by the conditions governing the freezing and storage operations.

3.239 EFFECT OF VARIOUS FREEZING METHODS ON QUALITY OF POULTRY MEAT

Marion, W. W. and Stadelman, W. J. (Purdue University, Lafayette, Indiana)
Food Technology 12, 367-369 (July 1958)

Chicken fryers, fowl, turkey fryers, and mature turkey toms were frozen by four different methods including liquid, plate, and moving air. Method of freezing was found to exert no significant effect on percentage drip, percentage total cooking loss, and tenderness of breast muscle.

3.330 APPERTIZED FISH PRESERVES

Durocher, J.
Industr. aliment agric. 73, 657-664 (1956)
Food Science Abstracts 29, 125 (April 1957)

About 62,000 tons of fish were canned in France in 1954, half of the total in oil, a quarter in light brine, and the rest marinaded, or in tomato or other sauces, or as soups. The procedures and equipment used are described.

3.3341 POPULAR NEW PRODUCT FROM FORMER WASTE

Hall, Leon and Fornea, Wayne (DeJean Packing Co., Biloxi, Mississippi)
Food Engineering 30, 74-75 (June 1958)

In the process of steaming oysters to open them for canning, the oyster liquor was wasted. To make use of this oyster liquor, facilities were installed to collect and refine the liquor for use in the manufacture of canned oyster stew. Oyster liquor, collected from the oysters in the steam box, is heated to 210° F., centrifuged, clarified, seasoned, mixed with the other ingredients used in the oyster stew, and filled into 8- and 10-ounce cans containing whole shucked oysters from the packing tables. These cans are sealed, sterilized, cooled, labeled, and cased for shipment.

4.21 STABILITY OF HYDROGENATED SAURY, (COLOLABIS SAIRA) AND WHALE OILS DETERMINED BY THE RATE OF INCREASE OF THEIR PEROXIDE VALUES

Takeda, Maromi and Toyama, Yoshiyuki (Nagoya Univ.)
Abura Kagaku 6, 152-6 (1957)
Mem. Fac. Eng. Nagoya Univ. 9, 132-9 (1957) (In English)
Chemical Abstracts 52, 11446 (July 10, 1958)

Several samples prepd. by hydrogenating saury and whale oils to different degrees kept at 50° were analyzed for peroxide value and fatty-acid compn. periodically.

4.21 AUTOXIDIZED SAURY OIL AND ITS HIGHLY UNSATURATED ACID FRACTION

Shimooka, Tsutomu; Murase, Masako; Nagakami, Takeshi; and Toyama, Yoshiyuki (Nagoya Univ.)
Abura Kagaku 6, 321-4 (1957)
Mem. Fac. Eng. Nagoya Univ. 9, 366-72 (1957) (In English)
Chemical Abstracts 52, 11445 (July 10, 1958)

The saury (Cololabis saira) oil autoxidized to different degrees by exposure to the sun or by air blowing at 50° was analyzed for the phys. and chem. characteristics, including OH no. and conjugated diene content.

4.4 DETERIORATIVE REACTIONS INVOLVING PHOSPHOLIPIDS AND LIPOPROTEINS

Lea, C. H. (Low Temperature Station for Research in Biochemistry and Biophysics, University of Cambridge, England)
Journal of the Science of Food and Agriculture 8, 1-13 (January 1957)

4.4 PROCEDURE FOR PREVENTING THE INCREASE IN ACID NUMBER OF RICE-BRAN OIL DURING STORAGE OF RICE BRAN

Tsujino, Kiro and Kitaichi, Kenji
Yushi Kagaku Kyokaishi 2, 139-43 (1953)
Chemical Abstracts 52, 11444 (July 10, 1958)

Heating rice bran at 120° for 5 to 10 min. inhibits development of the free fatty acids in the oil present during storage.

LIST OF PUBLICATIONS REGULARLY ABSTRACTED

Analyst
Analytical Chemistry
Archives of Biochemistry and Biophysics
Biochemical Journal
Biochemistry
Bulletin of the Faculty of Fisheries, Hokkaido University
Bulletin of the Japanese Society of Scientific Fisheries
California Fish and Game
Canadian Fisherman
Canadian Journal of Chemical Engineering
Canadian Journal of Chemistry
Canner and Freezer
Chemical Abstracts
Chemical and Engineering News
Chemical Engineering
Chemical Processing
Chemistry and Industry
Commercial Fisheries Review
Drug and Cosmetic Industry
FAO Fisheries Bulletins
Federation Proceedings
Feed Bag
Feedstuffs
Fisheries Newsletter (Australia)
Fish. Res. Bd. Can., Prog. Repts. Atlantic Coast Stas.
Fish. Res. Bd. Can., Prog. Repts. Pacific Coast Stas.
Fishing Gazette
Food Engineering
Food Manufacture
Food Packer
Food Preservation Quarterly
Food Processing
Food Research
Food Science Abstracts
Food Technology
Frosted Food Field
Industrial and Engineering Chemistry
Industrial Refrigeration
Journal of Agricultural and Food Chemistry
Journal of Applied Chemistry
Journal of Biological Chemistry
Journal of Nutrition
Journal of the American Chemical Society
Journal of the American Dietetic Association
Journal of the American Oil Chemists' Society
Journal of the Association of Official Agricultural Chemists
Journal of the Fisheries Research Board of Canada
Journal of the Science of Food and Agriculture
Maine Coast Fisherman
Modern Packaging
Modern Refrigeration
National Fisherman
National Provisioner
Nature
Nutrition Reviews
Pacific Fisherman
Poultry Science
Progressive Fish-Culturist
Quick Frozen Foods
Refrigerating Engineering
Report of the Food Investigation Board (Great Britain)
Science
Seafood Merchandising
Trade News (Fisheries Department, Canada)
Western Fisheries
World Fisheries Abstracts
World Fishing

Articles chosen for abstracting or inclusion as bibliographical references are those deemed of interest to the commercial fisheries and to fishery technological laboratories. Occasionally pertinent articles from sources other than the above-listed publications are included. Biological papers are generally omitted.

7.42 DETERMINATION OF SMALL QUANTITIES OF NITRITE IN FISH MEAL

Seibold, R. (Württ. Landesversuchsanst. Landw. Chem., Stuttgart-Hohenheim, Ger.)
Landwirtsch. Forsch. 10, 50-5 (1957)
Chemical Abstracts 51, 9029 (June 25, 1957)

Weigh a 10-g. sample into a 250-ml. Stohmann flask. Add about 100 ml. H_2O and 1 ml. 2N NaOH, shake for 30 min., dil. with water to the mark, and filter. Pipet 50 ml. of the filtrate into a 100-ml. volumetric flask, add 10 ml. 2N NaOH, and slowly add an equiv. vol. of 20 percent $AlCl_3$ soln. Shake, filter, pipet an aliquot of the colorless filtrate into a 50-ml. volumetric flask, add approx. 20 ml. of water, add 25 ml. test soln., and dil. immediately with water to the mark. After 30 min. measure the extinction at 525 mμ. The test soln. contains 0.4 g. p-nitroaniline and 0.7 g. 1-naphthylamine in 100 ml. MeOH and must be stored in the dark. Mix 8 ml. of this soln. with 50 ml. 10N HCl and dil. to 1.1.

7.42 THE LABORATORY EXAMINATION OF CANNED FOODS XV. DISSOLVED COPPER AND LEAD

Kefford, J. F. (Division of Food Preservation and Transport, C.S.I.R.O., Homebush, N.S.W.)
Food Preservation Quarterly 18, 25-29 (June 1958) (Sydney, Australia)

7.80 SEQUENTIAL ANALYSIS IN ORGANOLEPTIC RESEARCH: TRIANGLE, PAIRED, DUO-TRIO TESTS

Radkins, Andrew P. (Purdue University, Lafayette, Indiana)
Food Research 23, 225-234 (May-June 1958)

It is the purpose of this paper to explain and demonstrate a different approach to testing the statistical hypotheses associated with triangle, paired, and duo-trio tests. This suggested approach makes use of sequential analysis.

7.80 DETERMINATION OF VOLATILE REDUCING SUBSTANCES (VRS) AS AN AID IN THE OBJECTIVE ASSESSMENT OF THE FRESHNESS OF SEAFISH II. EVALUATION OF VRS VALUES WITH REGARD TO BEGINNING DECOMPOSITION

Wittfogel, H. and Gebhardt, R.
Arch. Lebensmittelhyg. 8, 270-2 (1957)
Chemical Abstracts 52, 9472 (June 10, 1958)

The combination of the VRS test (cf. Farber, C.A. 44, 1019h; 46, 11487h), bacterial count and organoleptic test permits a good evaluation of the quality of all kinds of raw fish. The upper limits for edibility were 30 milliequivalent VRS and 0.8 million bacteria/g. fish muscle.

7.81 HISTAMINE CONTENT OF SOME FOODS

Torres-Acero, J. M.
Anales de Bromatologia 8, No. 3, p. 345 (1956) (In Spanish)
World Fisheries Abstracts 9, 43-44 (March-April 1958)

The function of histamine in allergic processes is not very clear yet, but this substance is considered responsible for many intoxications produced by bacterial decomposition. The method of analysis followed by the author was the classic one by using ileum of guinea pig. Sardine (fat fish) gave a higher concentration than hake (lean fish) and prawn (shellfish), the only species studied. It is supposed that there is a relation between the content of histamine and the structure of fish proteins and other foods. The article includes 3 references, and a graph in which the effects of different concentrations of histamine on the ileum of guinea pig are plotted.

7.81 OCCURRENCE OF TRIMETHYLAMINE OXIDE, HOMARIN, TRIGONELLINE, AND A BASE $C_4H_9O_2N$ IN THE SHRIMP CRANGON VULGARIS

Ackermann, D. and List, P. H. (Univ. Würzburg, Ger.)
Z. physiol. Chem. 306, 260-4 (1957)
Chemical Abstracts 52, 11296 (July 10, 1958)

A fractionation method is given for the bases in an ext. of shrimp. Trimethylamine oxide, homarin, and trigonelline were detected and isolated. A base with the formula $C_4H_9O_2N$ was isolated but not further characterized. It was not dimethylglycine.

8.42 SODIUM AND POTASSIUM IN FISH FROM THE CANADIAN PACIFIC COAST

McBride, J. R. and MacLeod, Robert A. (Fisheries Research Board of Canada, Technological Station, Vancouver, British Columbia)
Journal of the American Dietetic Association 32, (July 1956)
Studies 1956, from the Stations of the Fisheries Research Board of Canada, FRB No. 434, 7 pp.

The sodium and potassium levels in the flesh of lingcod, graycod, halibut, herring, brill, lemon sole, and five species of salmon (genus Oncorhynchus) caught along the Pacific Coast of Canada are reported. In salmon, more variation in the sodium and potassium content occurred within a species than between species.

8.42 INFLUENCE OF STORAGE TIME ON THE TIN AND IRON CONTENT IN CANNED FISH PRODUCTS

Wierzchowski, Jozef and Severin, Maria
Roczniki Panstwowego Zakladu Hig. 8, 481-94 (1957) (English and Russian summaries)
Chemical Abstracts 52, 7563 (May 10, 1958)

Canned fish stored over periods up to 37 months was tested for Sn, Fe, and acidity of extd. fat. In all cases, a steady increase of Sn content with storage time was observed.

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8.51 THE AMINO-ACID COMPOSITION OF FISH-SCALE PROTEINS

Burley, R. W. and Solomons, C. C. (Natl. Chem. Research Lab., CSIR, Pretoria)
S. African Ind. Chem. 11, 154-7 (1957)
Chemical Abstracts 52, 2288 (February 10, 1958)

The amino-acid content of fish scales was detd. by the ion-exchange chromatographic method of Moore and Stein (C. A. 46, 2119c). The fish scales were Soxhlet extd. with hexane for 24 hrs. and demineralized, and the gelatin was sepd. from ichthylepidin. Amino-acid compns. of pilchard-scale gelatin and ichthylepidin are given.

8.51 PROTEINS IN SOME SPECIES OF FISH

Drilhon, Andreé and Fine, Jean M.
Compt. rend. 245, 1676-9 (1957)
Chemical Abstracts 52, 6652 (April 25, 1958)

The serum proteins of several species of fish were compared with those of human serum proteins with respect to electrophoretic behavior on paper and in gelatin gel.

8.51 INFLUENCE OF TEMPERATURE ON THE STATIONARY STATE OF THE NONPROTEIN AMINO ACID POOL OF THE MUSCLES OF ERIOCHEIR SINENSIS

Duchâteau, Ghislaine and Florkin, Marcel (Univ. Liegé, Belg.)
Arch. intern. physiol. et biochim. 63, 213-21 (1955)
Chemical Abstracts 52, 9451 (June 10, 1958)

8.51 CHEMICAL STUDIES ON THE RED MUSCLE OF FISHES VI. SOLUBILITIES OF RED MUSCLE MYOGLOBINS AND BLOOD HEMOGLOBINS

Matsuura, Fumio and Hashimoto, Kanehisa (Tokyo Univ.)
Nippon Suisangaku Kaishi 22, 408-12 (1956-57)
World Fisheries Abstracts 52, 10440 (June 25, 1958)

The solubilities decreased with decrease of pH, showing no definite min. values at isoelec. points. These properties are interpreted to be specific to the species of the fishes.

8.51 RELATIONS BETWEEN THE PROTEIN CONTENT AND THE NUTRITIONAL VALUE OF SEBASTES MARINUS

Brandes, C. H. and Dietrich, R. (Inst. Meeresforsch., Bremerhaven, Ger.)
Fette, Seifen, Anstrichmittel 59, 434-7 (1957)
Chemical Abstracts 52, 11306 (July 10, 1958)

Specimens (102) of S. marinus obtained over a period of time and at various places had an av. N to protein factor of 6.01 with limits of 5.54 to 6.41.

8.51 CONTRACTILE PROTEIN FROM CRAYFISH TAIL MUSCLE

Maruyama, K. (Univ. Tokyo)
Biol. Bull. 114, 95-105 (1958)
Chemical Abstracts 52, 11142 (July 10, 1958)

Physicochem. studies were made on the contractile protein (myosin B) extd. from tail muscle of the crayfish (Cambarus clarkii).

8.59 MARINE STEROLS II. 24-METHYLENECHOLESTEROL IN MOLLUSCS

Fagerlund, U. H. M. and Idler, D. R. (Pacific Fisheries Experimental Station, Vancouver 2, British Columbia)
Journal of Organic Chemistry 21, 372 (1956)
Studies 1956, from the Stations of the Fisheries Research Board of Canada, FRB No. 433

This paper reports the occurrence of 24-methylenecholesterol in scallop, Pecten caurinus, cockle, Cardium corbis, and in a commercially prepared crude sterol mixture extracted from mussel Modiolus demissus.

8.59 THE ACID-SOLUBLE NUCLEOTIDES OF SALMON LIVER

Tsuyuki, H.; Chang, Violet M.; and Idler, D. R. (Fisheries Research Board Can., Vancouver)
Can. J. Biochem. and Physiol. 36, 466-73 (1958)
Chemical Abstracts 52, 10445 (June 25, 1958)

The acid-sol. nucleotides of spring salmon liver were sepd. by anion-exchange chromatography at low temp. and characterized.

9.15 RAPID COUNTING OF NEMATODA IN SALMON BY PEPTIC DIGESTION

Stern, Joseph A.; Chakravarti, Diptiman; Uzmann, Joseph R.; and Hesselholt, Mary N. (College of Fisheries, University of Washington, Seattle)
Special Scientific Report: Fisheries No. 255, 5 pp. (May 1958) U. S. Department of the Interior, Fish and Wildlife Service, Washington 25, D. C.

The nematode parasite Anisakis sp. can be recovered, relatively unaltered, from chum salmon musculature by high temperature (52° ± 2° C.) peptic digestion of the flesh. The procedure, which is presented in detail, appears to be more thorough in isolation of the parasite than in dissection of the flesh and manual isolation of the worms.

The population of Anisakis sp. larvae in chum salmon appears to be concentrated in the ventral section of the fish; that is, below the lateral line, which suggests that only the ventral quarters of the fish need to be examined for estimating intensity of infection.

9.19 RADIOACTIVITY AND THE SEA FISHERIES

Schaefer, Milner B. (Inter-American Tropical Tuna Commission, La Jolla, California)
Pacific Fisherman 56, 11 (March 1958)

A committee of the National Academy of Sciences has recommended that (1) cognizant international agencies formulate conventions for the safe disposal of atomic wastes at sea based on existing scientific knowledge and that (2) nations be urged to collaborate in studies to develop comparative safe means of oceanic disposal for the large quantities of radioactive waste expected in the future.

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